APPENDIX C

Sanitation Analysis

SANITATION OVERVIEW & NON-DEGRADATION ANALYSIS FOR THE STONE RIDGE CLUB SUBDIVISION

SECTION 1 – SANITATION OVERVIEW

A. VICINITY MAP/PLAN

A vicinity map is located in Appendix A as well as a ½ size plot of the preliminary plat. From a sanitation prospective, all surface water features, wells, wastewater treatment systems, and mixing zones within 100-feet and any public water and sewer systems within 500 feet are shown on the preliminary plat.

B. DESCRIPTION

Water Supply System
Each lot will be supplied with water from a domestic well (< 35 gpm, < 10 acre-feet per year) constructed to the standards of ARM 17.36.333 Non-Public Water Supply Systems: Design and Construction. The proposed well locations are shown on the preliminary plat.

Storm Water System
All additional storm water run-off created by the subdivision will be handled and retained on site in driveway and road side ditches for infiltration into the ground. The proposed subdivision will require storm drainage approval based on Circular DEQ 8, "Montana Standards for Subdivision Storm Drainage".

Solid Waste Disposal
All garbage shall be stored in animal-proof containers or be made unavailable to animals per the subdivision restrictive covenants (Appendix F). A local service currently collects the solid waste on a weekly basis for the residences in Elk Hills Subdivision; the waste will be collected in the same manner for the proposed subdivision.

Wastewater Treatment System
There is currently no wastewater treatment systems located within the proposed subdivision. Each lot will utilize a new individual wastewater treatment system to be designed and approved by the Montana Department of Environmental Quality (MDEQ). Each individual wastewater treatment system will consist of a septic tank with effluent filter, dose tank, and a subsurface drainfield as per the Madison County and Montana DEQ standards. Each system will be installed on an individual basis as the lots are developed.

The nearest surface water is South Meadow Creek which runs from the west to the east, along the southern property line and though the southeast portion of the proposed subdivision. Due to the topography of the land the flood potential is assumed to not pose problems related to sanitation for this property. The proposed drainfields will be a minimum of 100 ft from any existing or proposed wells and 100 feet from surface water.

The average depth to groundwater in the area is 72.94 feet, and the minimum depth to groundwater near South Meadow Creek is 18 feet. There may be installation limitations for certain types of wastewater treatment systems, but based upon the terrain and achieving the minimum surface water setback distances, new systems could be installed for each lot. Possible locations of the proposed individual wastewater treatment systems are shown on the preliminary plat. These locations would require the approval of the Madison County Health Department and MDEQ. Calculations for pressure-dosed systems have been preliminarily designed for individual septic systems on each lot.

C. LOT LAYOUT

All required lot layout information (as per MDEQ requirements) is shown on the preliminary plat. All surface water features, wells, wastewater treatment systems, and mixing zones within 100-feet and any public water and sewer systems within 500 feet are shown on the preliminary plat.

D. SITE CONDITIONS

Soil Profile Description

The NRCS soil survey classifications (Appendix B) for the proposed subdivision are as follows: Beaverell cobbly loam, cool, 0 to 6 % slopes (17), Cryaquolls, nearly level (38), Nuley-Rock outcrop complex, 8 to 35 % slopes (91), and Varney clay loam, 2 to 8 % slopes (147). There are existing wastewater treatment systems (drainfields) in the area, located west and south of the proposed subdivision. Based on the existing systems in the vicinity and the NRCS soil info, the proposed subdivision should have suitable soils for individual on site wastewater treatment systems.

The proposed drainfields will be located a minimum of 100-feet away, in the direction of ground water flow, from any surface water or drinking water sources The direction of groundwater flow has been determined using the $^1/_3$ Regional Topographic Slope method. The direction of the ground water is approximately South 65° East (Appendix C2).

E. WATER AVAILABILITY

The attached well log summary (Appendix B) identifies all wells within Section 26 & Section 35, Township 4 South, Range 2 West as having an average yield of 39.47 gpm. Nearby wells indicate there is a sufficient groundwater supply for the proposed subdivision, with static water levels ranging between 18 & 230 feet below ground surface (bgs) and total well depths ranging between 40 & 400 feet bgs.

F. WATER QUALITY

The level of background nitrates was determined from a down gradient well. This well is located in the SE ¼, Section 8, Township 5 South, Range 1 West, Groundwater

Information Center, GWIC Id #:247287, Valley Garden Ranch. The nitrate test indicted a concentration of 1.02 mg/L (Appendix C1).

G. IMPACTS TO GROUNDWATER - PRELIMINARY ANALYSIS

Enclosed in Appendix C3 are the anticipated impacts from a proposed individual wastewater treatment system. See Appendix C3 for the nondegradation calculations.

SECTION 2 – NONDEGRADATION REPORT

A. PURPOSE

The purpose of this nondegradation analysis is to assess the impacts of development due to potential nutrient contributions to 'state surface waters' and potential nitrate contributions to 'state ground water' in close proximity to the proposed wastewater disposal system. All calculations and conclusions in this report are based on: MDEQ, How to Perform a Nondegradation Analysis, March 2005.

B. NUTRIENT IMPACT (PHOSPHORUS BREAKTHROUGH)

ASSUMPTIONS

1. 1.Use 6.44 lbs of phosphorus/household/year
2. Full time occupancy.
3. One cubic foot of soil weighs 100 lbs.
4. The entire area between the drain field (bottom of gravelless chambers) and maximum elevation of the water table or the first impermeable layer will absorb phosphorus.
5. The entire area between the drainfield (bottom of trenches) and maximum elevation of the water table or the first impermeable layer will absorb phosphorus. Use 4 ft as the worse case scenario.
6. Some absorption will take place in the horizontal distance between the drainfield and the surface water. This can be estimated by assuming the plume is the width of the drainfield as seen from the water body and 1 foot thick in fine textured soils and 0.5 feet in coarse soils. Use 0.5 ft for coarse soils.
7. Phosphorous Absorption is 200 grams for every million grams of soil.

PHOSPHORUS BREAKTHROUGH ANALYSIS

A phosphorous breakthrough time **(Bt)** of **50.2 years** was established for the worst case scenario for the proposed drainfield located on Lot 2. The distance from the drainfield to surface water is 367.3 ft. This distance was used in the phosphorous breakthrough analysis. The Bt value exceeds the MDEQ policy minimum of 50 years.

C. NITRATE SENSITIVITY ANALYSIS

Parameter		Source of Value Used In Analysis
Hydraulic conductivity	(K)	Hydraulic conductivity was determined using data from 3 nearby well logs and the Razack and Huntley Equation. See hydraulic

		conductivity calculation (Appendix C1) **K average = 70.81 ft/day**
Hydraulic gradient	(i)	Hydraulic gradient value was determined using the $^1/_3$ Regional Topographic Slope Method. See the Groundwater Flow Direction Map (Appendix C2). **I = 0.0187 ft/ft**
Aquifer dilution depth	(d)	From MDEQ, How to Perform a Nondegradation Analysis, March 2005. **d = 15.0 ft**
Down gradient mixing zone	(l)	From MDEQ, How to Perform a Nondegradation Analysis, March 2005. Use a 100 ft site specific mixing zone. **l = 100ft**
Background nitrate	(Ng)	Background nitrate concentration in groundwater determined using water sample from an existing down gradient well, from the Valley Garden Ranch well (GWICC #247287). **Ng = 1.02mg/L**
Nitrate concentration in Recharge	(Nr)	Naturally occurring nitrates in rainwater (in mg/L or ppm). **Nr = 1.0 mg/L**
Effluent Quality	(Ne)	From MDEQ, How to Perform a Nondegradation Analysis, March 2005. 50 mg/l assumes 60 mg/l into the tank, 10% removal in tank and 7% removal in drainfield for conventional systems. **Ne = 50 mg/L**
Number of families	(f)	Number of families on the drainfield. **f = 1**
Effluent Volume	(Qf)	From MDEQ, How to Perform a Nondegradation Analysis, March 2005. Use 200gpd for 2-5 bedrooms. Use 200 gpd ÷ 7.48 gal/ft^3 = 26.74 ft^3/day. **Qf = 26.74 ft^3/day**
Annual Precipitation	(p)	From the Western Regional Climate Center annual precipitation data (Appendix C2). Approximate annual rainfall is 12.04 in/year. **p = 12.04 in/yr**
Recharge	(I)	From MDEQ, How to Perform a Nondegradation Analysis, March 2005. Use 20% of annual precipitation. **I = 0.20**

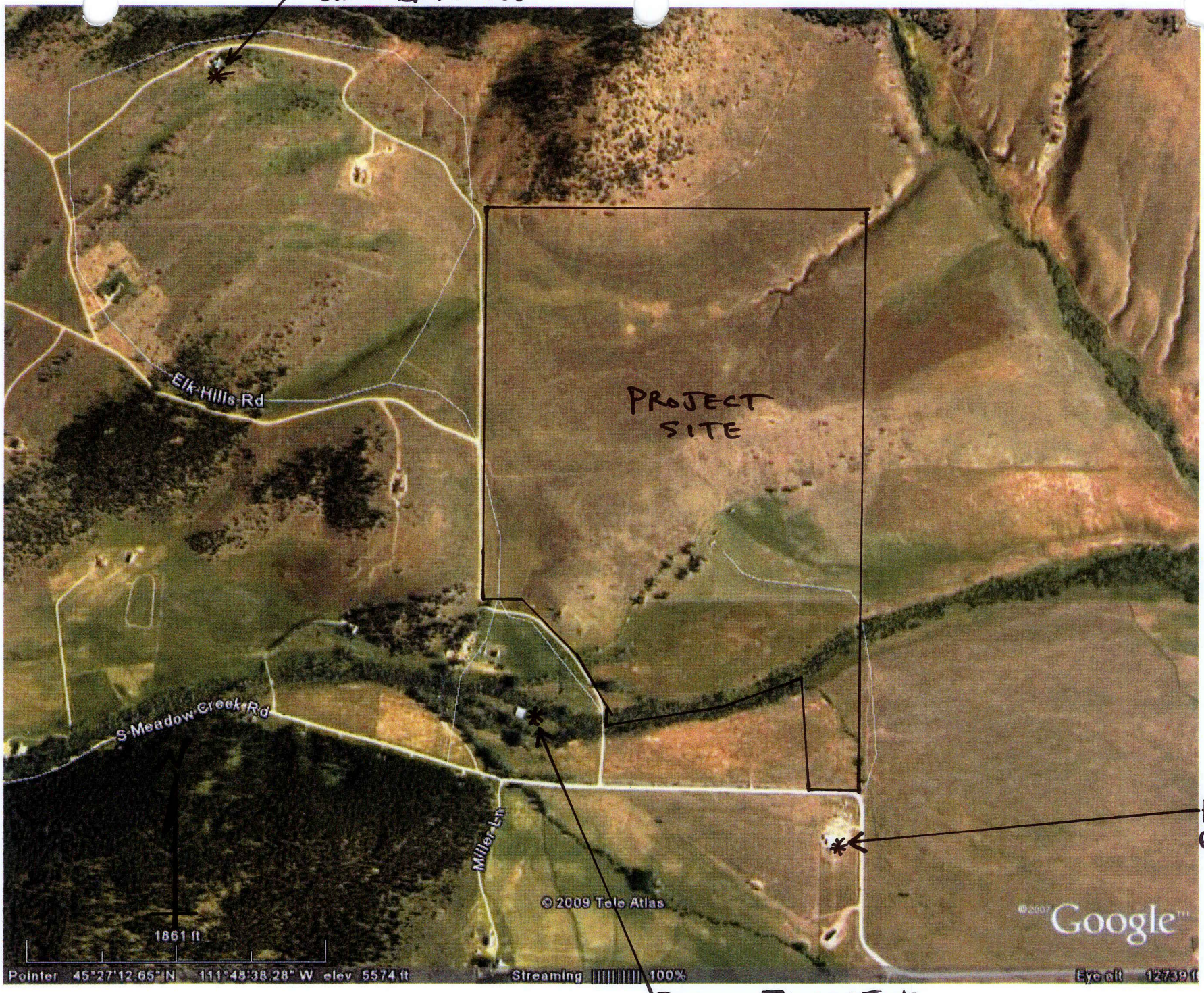
CONCLUSIONS:

A final **Nt** value **of 2.06 mg/L** was established at the end of the 100-foot mixing zone for the proposed drainfield on Lot 4, using the worst case of cumulative effects. This concentration is far below the current allowable concentration as listed in MDEQ criteria for Non-Significant Changes in Water Quality (5.00mg/L). By meeting the current allowable concentration, it is unlikely that the proposed drainfields will significantly affect the underlying aquifer.

APPENDICIES:

C1: Well Map & Logs, Hydraulic Conductivity Calculation, Background Nitrate
C2: Groundwater Flow Direction Map, Precipitation Data
C3: Nondegradation Calculations

WELL LOCATION MAP



Fetter

BORSUK, JEFF		**HOE, TIM & RENE**		**PATRICK, JAMES & JANE**	
GWIC ID: 155088		**GWIC ID: 204531**		**GWIC ID: 221978**	
Q (gpm)	20	Q (gpm)	75	Q (gpm)	45
Static level	113	Static level	48	Static level	18
Pump level	285	Pump level	100	Pump level	95
S (drawdown)	172	S (drawdown)	52	S (drawdown)	77
b* (aquifer thickness)	10	b* (aquifer thickness)	10	b* (aquifer thickness)	20
K	**26.96**	**K**	**145.71**	**K**	**39.77**

Average **70.81**

* Well Completion Type	Aquifer Thickness
Perforated or screened	Perforation/screen thickness
Open Bottom	10 feet
Open Hole	Open hole interval (i.e. distance between bottom of casing and bottom of borehole)

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map
View scanned well log (4/10/2008 2:29:41 PM)

Site Name: BORSUK JEFF
GWIC Id: 155088
DNRC Water Right: C098022-00

Section 1: Well Owner

Owner Name
BORSUK JEFF
Mailing Address
53 VIA FLOREADO

City	State	Zip Code
ORINDA	CA	94563

Section 2: Location

Township	Range	Section	Quarter Sections
04S	02W	26	NE¼ SW¼ NW¼

County
MADISON

Geocode

Latitude	Longitude	Geomethod	Datum
45.461561	111.820136	TRS-SEC	NAD83

Altitude	Method	Datum	Date

Addition	Block	Lot
ELKHILLS MCALLISTER		20

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method: ROTARY

Section 5: Well Completion Date
Date well completed: Tuesday, September 05, 1995

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	20	10
20	285	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	18	6	0.250		WELDED	STEEL
10	285	4		180.00		PVC-SCHED80

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
275	285	4		1/4 IN	DRILL HOLES

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	BENTONITE	

Section 7: Well Test Data

Total Depth: 285
Static Water Level: 113
Water Temperature:

Air Test *

20 gpm with drill stem set at _ feet for 2 hours.
Time of recovery 0.5 hours.
Recovery water level 113 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	8	TOPSOIL
8	84	GRANITE
84	91	SANDSTONE BROWN
91	140	GRANITE
140	146	BLACK GRANITE
146	285	GRANITE

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: MADISON DRILLING & PUMP SUPPLY
License No: WWC-557
Date Completed: 9/5/1995

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map
View scanned well log (4/10/2008 2:49:47 PM)

Site Name: HOE TIM AND RENE
GWIC Id: 204531

Section 1: Well Owner

Owner Name
HOE TIM AND RENE
Mailing Address
PO BOX 936

City	State	Zip Code
ENNIS	MT	59729

Section 2: Location

Township	Range	Section	Quarter Sections
04S	02W	35	

County MADISON
Geocode

Latitude	Longitude	Geomethod	Datum
45.4468	111.8046	NAV-GPS	NAD27

Altitude	Method	Datum	Date

Addition TOM MILLER MINOR 2
Block
Lot

Section 3: Proposed Use of Water

DOMESTIC (1)

Section 4: Type of Work

Drilling Method: ROTARY

Section 5: Well Completion Date

Date well completed: Wednesday, July 09, 2003

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	20	10
20	100	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	100	6	0.250		WELDED	STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
100	100	6			OPEN BOTTOM

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	0	BENTONITE	Y

Section 7: Well Test Data

Total Depth: 100
Static Water Level: 48
Water Temperature:

Air Test *

75 gpm with drill stem set at 100 feet for 2 hours.
Time of recovery 0.5 hours.
Recovery water level 48 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	1	TOPSOIL
1	80	GRAVEL
80	100	CEMENTED GRAVEL

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: MADISON DRILLING & PUMP SUPPLY
License No: WWC-557
Date Completed: 7/9/2003

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Plot this site on a topographic map
View scanned well log (10/31/2005 4:15:00 PM)

Site Name: PATRICK JAMES AND JANE
GWIC Id: 221978

Section 1: Well Owner

Owner Name
PATRICK JAMES AND JANE
Mailing Address
PO BOX 412

City	State	Zip Code
MCALLISTER	MT	59740

Section 2: Location

Township	Range	Section	Quarter Sections
04S	02W	35	NE¼ NW¼

County
MADISON
Geocode

Latitude	Longitude	Geomethod	Datum
45.4508	111.8144	SUR-GPS	WGS84

Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method:

Section 5: Well Completion Date
Date well completed: Friday, July 08, 2005

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	100	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-1.5	26	6	0.250		WELDED	STEEL
20	100	4		200.00		PVC

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
80	100	4	8	1/8X6IN	SAW SLOTS

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	0	BENTONITE	Y

Section 7: Well Test Data

Total Depth: 100
Static Water Level: 18
Water Temperature:

Air Test *

45 gpm with drill stem set at 95 feet for 1.5 hours.
Time of recovery 1 hours.
Recovery water level 18 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	4	TOPSOIL
4	19	SOFT BROWN DECOMPOSED GRANITE
19	85	HARD GRAY DECOMPOSED GRANITE
85	100	FRACTURED GRAY BROWN GRANITE AND WATER

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: GRAHAM DRILLING INC
License No: WWC-40
Date Completed: 7/8/2005

BRIDGER ANALYTICAL LAB, INC.

7539 Pioneer Way Suite C, Bozeman, MT 59718 Phone: (406) 582-0822 Fax: (406) 582-0967

Company Name:	C & H ENGINEERING & SURVEYING	**Report Date:**	11/24/2008
Chain of Custody:	03021	**Collection Date:**	11/19/2008 - 16:32
PO / Project Number	Valley Garden Ranch HQ	**Collected By:**	Mike Welch
Client Sample ID:	VGR-HQ	**Date Recieved:**	11/20/2008
Lab Sample ID:	BAL200803324	**Matrix:**	Water
PWSID:		**Workorder ID:**	2934

Analyses	Results	Units	Qualifiers	RL	MCL	Method	Analysis Date / by	Reviewed Date / by
Inorganic								
Conductivity	355	µS/cm	0	0.00		SM2510B	11/20/08 14:00 / RI	11/20/08 21:49 / ED
Nitrate + Nitrite as N	1.02	mg/L	0	0.04	10	EPA 300.1	11/20/08 13:30 / RI	11/20/08 21:43 / ED
Microbiological								
E-coli	Absent	cfu/100 mL	0	1.00		SM 9223B	11/20/08 15:05 / RI	11/24/08 07:15 / ED
Total Coliform	Absent	cfu/100 mL	0	1.00		SM 9223B	11/20/08 15:05 / RI	11/24/08 07:15 / ED

Comment:

MCL - Maximum Contaminant Level ND - Not Detected

RL - Reporting Limit cfu - Colony Forming Unit

MONTANA WELL LOG REPORT

Other Options

Plot this site on a topographic

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is complied electronically from the contents of the Ground-Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Site Name: VALLEY GARDEN RANCH
GWIC Id: 247287

Section 1: Well Owner

Owner Name
VALLEY GARDEN RANCH
Mailing Address
5313 NORTH HWY 287

City	State	Zip Code
ENNIS	MT	59729

Well Address
SAME

City	State	Zip Code

Section 2: Location

Township	Range	Section	Quarter Sections
05S	01W	8	SW¼ SW¼ SE¼

County MADISON **Geocode**

Latitude	Longitude	Geomethod	Datum
45.4082	111.7497	NAV-GPS	WGS84

Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water

DOMESTIC (1)
STOCKWATER (2)

Section 4: Type of Work

Drilling Method: ROTARY

Section 5: Well Completion Date

Date well completed: Tuesday, September 09, 2008

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	65	7.3

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	65	6.6	0.25		WELDED	A53B STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
65	65	6	1	6"	OPEN BOTTOM

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	0	CASING SEAL	Y

Section 7: Well Test Data

Total Depth: 65
Static Water Level: 32
Water Temperature:

Air Test *

60 gpm with drill stem set at 55 feet for 1 hours.
Time of recovery 1 hours.
Recovery water level 32 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

HEADQUARTERS RANCH WELL

Section 9: Well Log

Geologic Source
Unassigned

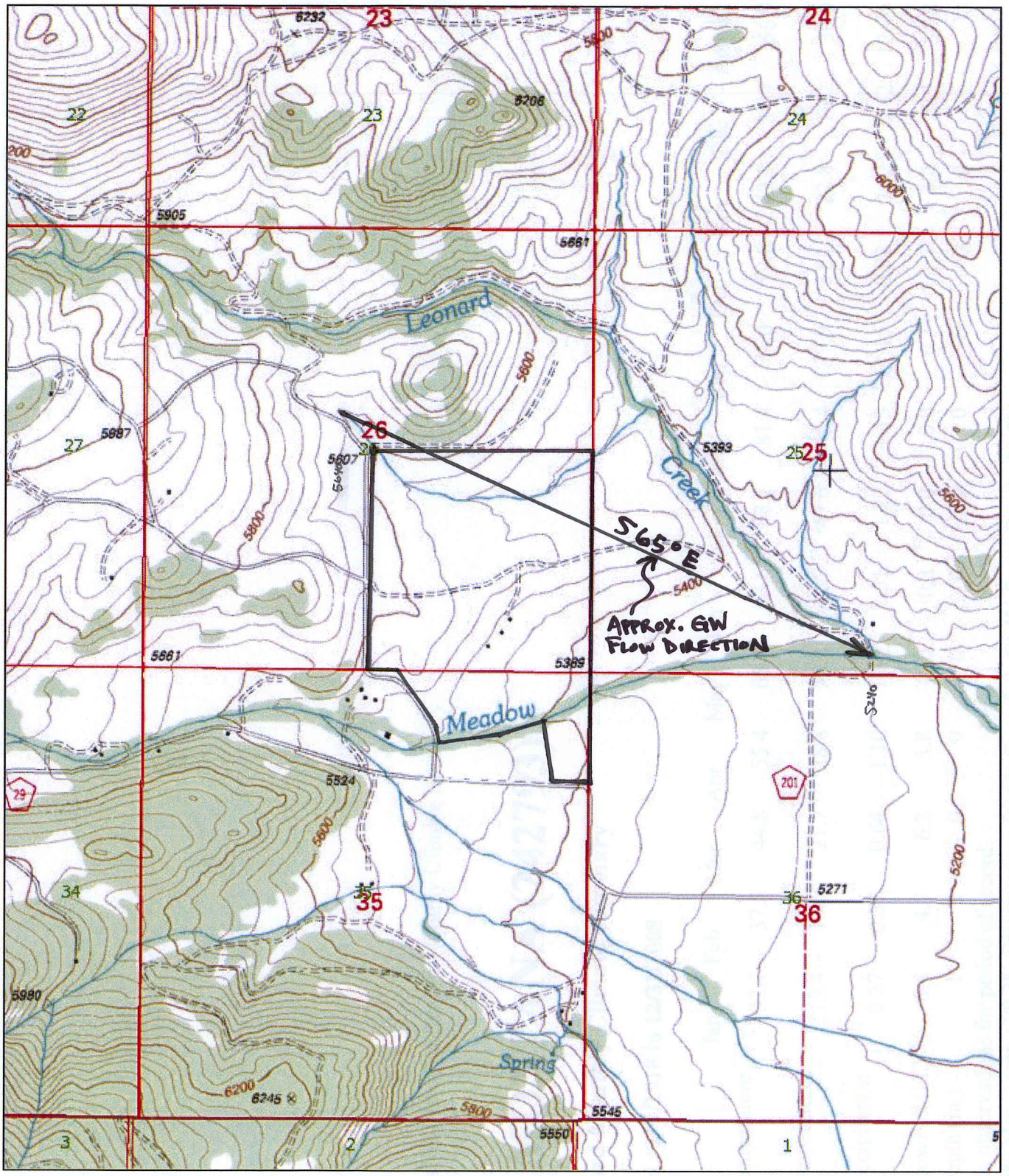
From	To	Description
0	14	TOP SOIL W/SILT SAND
14	26	FINESAND GRAVELS & COBBLES
26	32	SILTY CLAY
32	35	FINE SAND & GRAVELS
35	44	HEAVING FINE/COURSE SANDS
44	49	FINE SAND & GRAVELS
49	52	SILTY CLAY W/HEAVING FINE SAND STREAKS
52	65	FINE SAND GRAVEL W/60 GPM WATER

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: TROY HAUSER
Company: RED TIGER DRILLING INC
License No: WWC-598
Date Completed: 9/9/2008

GROUNDWATER FLOW DIRECTION



Slope = $\frac{400\text{ft}}{7143\text{ft}} = .056\text{ft/ft} = 5.6\%$

HYD. GRAD. = 1/3 × Slope
= 1/3 × 0.056 ft/ft

HYD. GRAD. = 0.0187 ft/ft @ S65°E

Appendix M

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

PHOSPHOROUS BREAKTHROUGH ANALYSIS

SITE NAME: Stone Ridge Club
COUNTY: Madison
LOT #: Lot 2
NOTES: Worst Case

VARIABLES	DESCRIPTION	VALUE	UNITS
Lg	Length of Primary Drainfield as Measured Perpendicular to Ground Water Flow	37.2	ft
L	Length of Primary Drainfield's Long Axis	85.5	ft
W	Width of Primary Drainfield's Short Axis	10.0	ft
B	Depth to Limiting Layer from Bottom of Drainfield Laterals*	4.0	ft
D	Distance from Drainfield to Surface Water	367.3	ft
T	Phosphorous Mixing Depth in Ground Water (0.5 ft for coarse soils, 1.0 ft for fine soils)**	0.5	ft
Ne			
Sw	Soil Weight (usually constant)	100.0	lb/ft3
Pa	Phosphorous Adsorption Capacity of Soil (usually constant)	200.0	ppm
#I	Number of Single Family Homes on the Drainfield	1.0	
CONSTANTS			
PI	Phosphorous Load per Single Family Home (constant)	6.44	lbs/yr
X	Conversion Factor for ppm to percentage (constant)	1.0E+06	
EQUATIONS			
Pt	Total Phosphorous Load = (PI)(#I)	6.44	lbs/yr
W1	Soil Weight under Drainfield = (L)(W)(B)(Sw)	342000.0	lbs
W2	Soil Weight from Drainfield to Surface Water = [(Lg)(D) + (0.0875)(D)(D)] (T)(Sw)	1273355.4	lbs
P	Total Phosphorous Adsorption by Soils = (W1 + W2)[(Pa)/(X)]	323.1	lbs
SOLUTION			
BT	**Breakthrough Time to Surface Water = P / Pt**	50.2	years

BY: SL
DATE: August 11, 2009

NOTES:

** Depth to limiting layer is typically based on depth to water in a test pit or bottom of a dry test pit minus two feet to account for burial depth of standard drainfield laterals.*
*** Material type is usually based on test pit. A soil that can be described as loam (e.g. gravelly loam, sandy loam, etc.) or finer according to the USDA soil texture classification system is considered a "fine" soil.*

REV. 12/2004

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY

NITRATE SENSITIVITY ANALYSIS

SITE NAME: Stone Ridge Club
COUNTY: Madison
NOTES: Worst Case

BY: SL
DATE: 08/11/09

Nitrate at end of mixing zone(s) with no cumulative effects

Variable	(K)	(I)	(D)	(L)	(Y)	(Ng)	(Nr)	(Ne)	(#l)	(Ql)	(P)	(V)	(W)	(Am)	(As)	(Qg)	(Qr)	(Qe)	Nt
LOT #	Hydr. cond. (ft/day)	Hydr. grad. (ft/ft)	Mix zone thick (feet)	Down grad. distance (feet)	Drain-field width (feet)	Back-ground nitrate (mg/l)	Nitrate in precip (mg/l)	Effluent Nitrate conc. (mg/l)	# of single family homes	Effluent per drain. (ft3/day)	Annual precip. (in/yr)	Percent precip. recharge	Down-grad. width (feet)	Mix zone area (ft²)	Mix. zone surface area (ft²)	Ground water flow (ft3/day)	Recharge flow (ft3/day)	Effluent flow (ft3/day)	Resulting nitrate (N) (mg/l)
16	70.81	0.019	15.0	100	59.5	1.02	1.0	50.0	1.0	26.70	12.0	0.2	77.04	1155.60	7704.00	1530.18	4.24	26.70	1.86
18	70.81	0.019	15.0	100	68.6	1.02	1.0	50.0	1.0	26.70	12.0	0.2	86.05	1290.75	8605.00	1709.14	4.73	26.70	1.77
4	70.81	0.019	15.0	100	78.2	1.02	1.0	50.0	1.0	26.70	12.0	0.2	95.68	1435.20	9568.00	1900.42	5.26	26.70	1.70
													0.00	0.00	0.00	0.00	0.00	0.00	
													0.00	0.00	0.00	0.00	0.00	0.00	
													0.00	0.00	0.00	0.00	0.00	0.00	
													0.00	0.00	0.00	0.00	0.00	0.00	
													0.00	0.00	0.00	0.00	0.00	0.00	
													0.00	0.00	0.00	0.00	0.00	0.00	
													0.00	0.00	0.00	0.00	0.00	0.00	
													0.00	0.00	0.00	0.00	0.00	0.00	

Nitrate at end of mixing zones with cumulative effects

LOT #	(K)	(I)	(D)	(L)	(Y)	(Ng)	(Nr)	(Ne)	(#l)	(Ql)	(P)	(V)	(W)	(Am)	(As)	(Qg)	(Qr)	(Qe)	Nt
16	70.81	0.019	15.0	2073	59.5	1.02	1.0	50.0	1.0	26.70	12.0	0.2	422.39	6335.88	875804.47	8389.64	481.49	26.70	1.17
18	70.81	0.019	15.0	1306	68.6	1.17	1.0	50.0	1.0	26.70	0.0	0.2	297.01	4455.19	387749.82	5899.32	0.00	26.70	1.39
4	70.81	0.019	15.0	100	78.2	1.39	1.0	50.0	1.0	26.70	0.0	0.2	95.68	1435.20	9568.00	1900.42	0.00	26.70	2.06
						2.06							0.00	0.00	0.00	0.00	0.00	0.00	
													0.00	0.00	0.00	0.00	0.00	0.00	
													0.00	0.00	0.00	0.00	0.00	0.00	
													0.00	0.00	0.00	0.00	0.00	0.00	
													0.00	0.00	0.00	0.00	0.00	0.00	
													0.00	0.00	0.00	0.00	0.00	0.00	
													0.00	0.00	0.00	0.00	0.00	0.00	

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NOTES:			
	= fill in values in these cells		
	= these cells are calculated for you		
Hydr. cond. =		*K*	Hydraulic Conductivity
Hydr. grad. =		*I*	Hydraulic Gradient
Mix zone thick =		*D*	Thickness of Mixing Zone up to a Maximum of 15 feet (usually constant at 15 feet)
Down grad. distance =		*L*	Mixing Zone Length (see ARM 17.30.517(1)(d)(viii), or this may also be the distance to end of last mixing zone when calculating cumulative effects.
Drainfield width =		*Y*	Width of Drainfield Perpendicular to Ground Water Flow
Background nitrate =		*Ng*	Background Nitrate (as Nitrogen) Concentration
Nitrate in precip. =		*Nr*	Nitrate (as Nitrogen) Concentration in Precipitation (usually constant at 1.0 mg/L)
Effluent Nitrate conc. =		*Ne*	Nitrate (as Nitrogen) Concentration in Effluent (50 for conventional; 24 for level II; 30 for level 1a; 40 for level 1b)
# single family homes =		*#I*	Number of Single Family Homes on the Drainfield (leave as 1 if effluent volume in next column is adjusted to equal total effluent from drainfield)
Effluent per drain. =		*QI*	Quantity of Effluent from drainfield (average rate varies depending on number of bedrooms)
Annual precip. =		*P*	Annual local Precipitation
Percent precip recharge =		*V*	Percent of Precipitation Recharging Ground Water (usually constant at 0.2)
Down grad. width =		*W*	Width of Mixing Zone Perpendicular to Ground Water Flow = (0.175)(L) + (Y)
Mix zone area =		*Am*	Cross Sectional Area of Aquifer Mixing Zone = (D)(W)
Mix zone surface area =		*As*	Surface Area of Mixing Zone = (L)(W)
Ground water flow =		*Qg*	Ground Water Flow Rate = (K)(I)(Am)
Recharge flow =		*Qr*	Recharge Flow Rate = (As)(P/12/365)(V)
Effluent flow =		*Qe*	Effluent Flow Rate = (#I)(QI)
Resulting nitrate (N) =		*Nt*	Nitrate (as Nitrogen) Concentration at End of Mixing Zone = ((Ng)(Qg) + (Nr)(Qr) + (Ne)(Qe)) / ((Qg) + (Qr) + (Qe))
			(or nitrate concentration to use as background nitrate for next downgradient drainfield when determining cumulative effects)